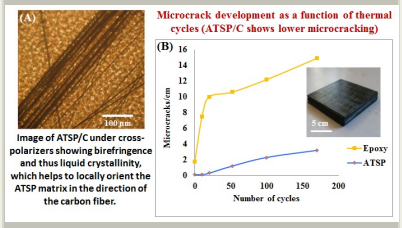
Small Business Innovation Research/Small Business Tech Transfer

Aromatic Thermosetting coPolyester Composites for High Temperature and Cryogenic Applications, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

Advanced composite materials processable by cost-effective manufacturing play an important role in developing lightweight structures for future exploratory missions. With growing demand for improved mission performance and reductions vehicle mass, advances in polymer systems with extreme thermo-mechanical properties are critical. The primary objective of ATSP Innovations' Phase I work will be to fabricate and test low cost aromatic thermosetting copolyesters (ATSP): (1) for high performance composite structures for high temperature applications, (2) with high resistance to microcracking at cryogenic temperatures for use in next generation spacecraft missions. Our team partner, the University of Illinois at Urbana-Champaign (UIUC) will assist ATSP Innovations to perform advanced characterization and provide technical support for this project. ATSP Innovations and UIUC have developed ATSP for high performance composites that are stable at high temperatures and have an intrinsic resistance to microcracking. The liquid crystallinity of the polymer results in a local matching of CTE between fiber and matrix yielding minimal thermal residual stress in composites and higher fracture toughness than current resin systems. These capabilities allow the ATSP to address a wide range of current and future applications (at both cryogenic and high temperature regimes) critical to future NASA missions. The synthetic development of ATSP was a major innovation in the field of polymer science. ATSP shows excellent performance as adhesives, flame resistant foams, and tribological wear coatings. ATSP resins possess the unique attribute among high temperature thermosets of solid-state bonding in a fully cured state to produce chemically contiguous specimens by Interchain Transesterification Reaction (ITR). This may open new modes of fabrication with relevance to NASA missions and the wider aerospace industry.



Aromatic Thermosetting coPolyester Composites for High Temperature and Cryogenic Applications Project Image

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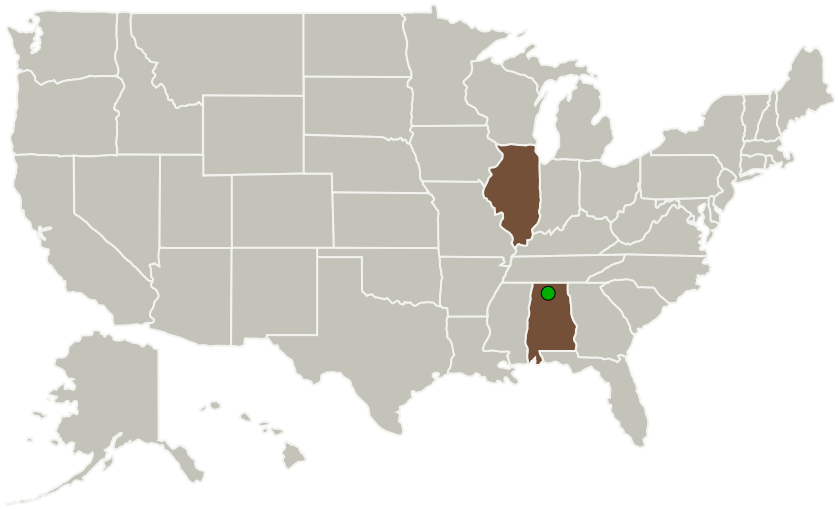
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
ATSP Innovations	Lead Organization	Industry	Champaign, Illinois
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Illinois

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137550)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ATSP Innovations

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

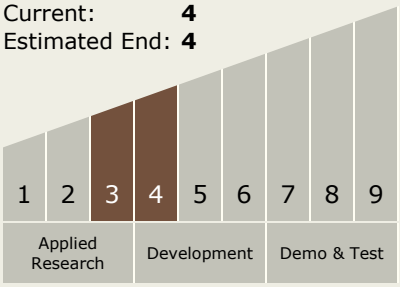
Carlos Torrez

Principal Investigator:

Bita Vaezian

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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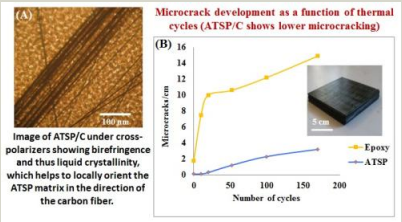
Images



Project Image
Aromatic Thermosetting coPolyester Composites for High Temperature and Cryogenic Applications Project Image *(https://techport.nasa.gov/image/129474)*

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System